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AIR POLLUTION BY DUST OF THE TOKYO-YOKOHAMA INDUSTRIAL AREA (18TH REPORT)

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1. Purpose

When studying air pollution in industrial cities, the dust fall ought to be given serious consideration as an index of the degree of pollution, even though there may be various problems at issue. Nevertheless, the heavy metal microelements contained in the dust fall have not been estimated on a broad basis.

For this reason, the authors attempted to estimate the heavy metals in the dust fall in the Tokyo-Yokohama industrial area and its peripheral areas. Analyzing the results, they attempted to elucidate the state of air pollution in these areas.

2. Methods

The monthly dust deposits were collected during the period from February, 1967, until January, 1968, by means of deposit

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gauges installed at six places in the Tokyo-Yokohama industrial area and its peripheral areas.

The dust deposits (total amount) obtained in this way were each processed by means of mixed acids, and the Ti, V, Cr, Mn, Fe, Ni, and Pb were estimated by the absorption photometry method.

3. Results

The mean analytical results for dust fall at each measuring point and each season are shown in Table 1. The mean amounts of deposits by component, calculated from the analytical results and from the total amount of dust fall are shown in Table 2.

TABLE 1. MEAN ANALYTICAL RESULTS FOR DUST FALL (%)

Meas. point	Cold season Ti	V	Cr	Mn	Fe	Ni	Pb	Meas. point	Warm season Ti	V	Cr	Mn	Fe	Ni	Pb
A	0.22	0.022	0.013	0.15	15.7	0.010	0.034	A	0.18	0.027	0.015	0.14	4.55	0.016	0.046
B	0.06	0.078	0.012	0.10	5.2	0.008	0.037	B	0.08	0.128	0.013	0.11	7.2	0.007	0.014
C	0.23	0.031	0.019	0.17	11.8	0.009	0.102	C	0.17	0.030	0.010	0.14	10.7	0.005	0.024
D	0.21	0.042	0.015	0.11	7.8	0.024	0.140	D	0.19	0.031	0.012	0.09	7.5	0.011	0.140
E	0.32	0.027	0.021	0.10	6.5	0.021	0.114	E	0.23	0.032	0.020	0.12	6.5	0.024	0.108
F	0.23	0.044	0.015	0.09	6.0	0.022	0.123	F	0.21	0.031	0.012	0.10	5.6	0.018	0.096

TABLE 2. MEAN AMOUNTS OF DEPOSITS BY COMPONENTS (kg/km^2/month)

Meas. point	Cold Season Ti	V	Cr	Mn	Fe	Ni	Pb	Meas. point	Warm season Ti	V	Cr	Mn	Fe	Ni	Pb
A	166	17	10	111	11228	8	24	A	99	14	8	73	8048	8	25
B	17	23	3	28	1558	15	11	B	18	26	3	26	1535	17	10
C	37	4	9	27	1894	7	14	C	47	8	13	40	3613	10	18
D	18	4	1	11	717	2	13	D	22	4	1	11	983	3	20
E	18	2	2	6	955	1	7	E	19	3	2	10	1523	2	9
F	14	3	1	5	953	1	7	F	16	2	1	7	953	1	7

As is shown in Table 2, the amounts of deposits by components decline as one moves further away from the central part of the industrial area. Equation (1) applies approximately between the amount of deposits and the distance away from the central part of the industrial area.

$$D_p = \frac{d}{x^l} \qquad (1)$$

Here, D_p — amount of deposits (dust fall) (kg/km^2 · month);

x — distance away from central part of industrial area (km);

d, l — constants.

Here, d and l are values indicating the amount of deposits near the central part of the industrial area and the degree of decline depending on the distance. Examples of results of calculations of them are shown in Table 3.

TABLE 3. RESULTS OF CALCULATIONS OF d AND l (FEBRUARY, 1967)

	Ti	V	Cr	Mn	Fe	Ni	Pb	Total
d	237	36	18	204	17739	16	37	139×10
l	1.11	0.37	1.04	1.27	1.40	0.77	0.52	1.19

TABLE 4. DUST FALL IN AREA WITHIN RADIUS OF 20 km (TON/MONTH)

Ti	V	Cr	Mn	Fe	Ni	Pb
244	5.7	2.2	12.5	1120	0.2	12.5

Next, let us consider these results in connection with the results obtained on a monthly basis, and with the variations of l. The values for Fe and Mn were relatively large; in fact, they were larger than the values of the total monthly amounts of dust. On the other hand, it was observed that the values for Pb were small every month. As for Ni, V, and Cr, it was learned that only during the period of the year when buildings are heated, the values are smaller than the l for the entire amount of dust. It was thus observed that certain metals have different degrees of decline, depending upon the distance away from the center of the inudstrial area. It is believed that it would be interesting to consider the chief sources of generation. When the amounts of deposits by components within an area marked off by drawing a circle with a radius of 20 km, centering around the center of the industrial area, were estimated from these distribution functions, results such as those in Table 4 were obtained. From these results, it was learned that large amounts of heavy metal deposits are falling inside this area.